

New terebellids (Polychaeta: Terebellidae) living in colonies of a stony coral in the state of São Paulo, Brazil

J. M. de M. Nogueira and A. C. Z. Amaral

(JMMN, ACZA) Departamento de Zoologia, Instituto de Biologia, Universidade Estadual de Campinas - UNICAMP, CP 6109, CEP 13083-970, Campinas, SP, Brazil
e-mail: jmmnogueira@hotmail.com

Abstract.—Two new species of Terebellidae, one of which also a new genus, were identified among the polychaetes associated with a stony coral in the state of São Paulo, southeastern Brazil. *Morgana bisetosa*, n. gen., n. sp. is an abranchiate Terebellinae with 18–25 pairs of notopodia, present from segment 4, all with two types of chaetae: bilimbate capillaries and serrated chaetae; neuropodia from segment 6, neurochaetal uncini, arranged initially in single rows, but in double rows from the sixth torus, continuing posteriorly. *Streblosoma oligobranchiatum*, n. sp. (subfamily Thelepodinae) has few branchial filaments inserted almost laterally on segments 2–4; 22–26 pairs of notopodia, with no-tochaetae as bilimbate capillaries and shorter spatulate chaetae with acuminate tips. A discussion of the relationships of these new species to closely related species is given.

The polychaete family Terebellidae Malmgren, 1867 comprises tubiculous and non-tubiculous species with numerous buccal tentacles, grooved, which are not retractile into the mouth. Although some species lack chaetae, notopodia generally possess capillary chaetae, with varied degrees of ornamentation, and neuropodia have uncini arranged in double rows for at least a few chaetigers; notopodia usually finish before the end of the body, and in several taxa the end of notopodia determines the transition between thorax and abdomen. Branchiae are completely absent in Polycirrinae and in some genera of Terebellinae, are present in Thelepodinae as unbranched filaments, and as large arborescent structures, or as single or branched filaments in most of the Terebellinae (Hutchings 1977, Hutchings & Murray 1984, Fauchald & Rouse 1997).

Terebellids are subdivided into three subfamilies: Terebellinae Linnaeus, 1767, Thelepodinae Hesse, 1917, and Polycirrinae Malmgren, 1866, depending on the presence or absence of branchiae, their struc-

ture, and on the arrangement of neuropodial uncini. A fourth family, Artacaminae Malmgren, 1866, has recently been synonymized with Terebellinae (McHugh 1995).

Brazilian terebellids have been studied by Nonato & Luna (1970), Rullier & Amoureux (1979), Nonato (1981), Blankensteyn (1988), and Morgado & Amaral (1989), among others. Prior to the present study, 28 species had been identified along the Brazilian coast, belonging to 15 genera.

Two new species of terebellids were identified among the material collected for a study of the polychaetes living in colonies of the stony coral *Mussismilia hispida* (Verrill, 1868) on islands off the coast of the state of São Paulo. These new species, herein described, are in a new genus of Terebellinae, and a new species in the Thelepodinae genus *Streblosoma* Sars, 1872.

Materials and Methods

Twelve colonies of *Mussismilia hispida* were collected at Laje de Santos (24°19'S,

46°11'W) and Ilha dos Alcatrazes (26°06'S, 45°42'W), on 17 Mar 1996 and 4 Dec 1996, respectively. Both locations are rocky shores with hemispherical colonies of *M. hispida* spread over the rocks, as well as large colonies of the cnidarians *Palythoa* and *Zoanthus*, and some algal tufts. Corals were fixed with formalin (4%) and subsequently de-calcified with formaline-formic acid solution; polychaetes were sorted from the resultant residue, washed in 70% alcohol, and identified.

Observations and measurements were made using interference contrast optics (Nomarsky). Drawings were made with drawing tubes. Observations and micrographs by scanning electronic microscopy (SEM) were made at Laboratório de Microscopia Eletrônica do Instituto de Biociências da Universidade de São Paulo (IB-USP), except for Figs. 2B and 2C, which were taken at Laboratório de Microscopia Eletrônica do Instituto de Biologia da Universidade Estadual de Campinas (IB-UNICAMP); these observations were made after critical point drying and coating with a 25 nm thickness of gold. Types are deposited at Museu de História Natural, Instituto de Biologia, Universidade Estadual de Campinas (MHN-BPO 80 and MHN-BPO 81) and at The Australian Museum (W 27132 and W 27133).

Family Terebellidae Malmgren, 1867

Subfamily Terebellinae Linnaeus, 1767

Terebellids with compact prostomium, notopodia present on a variable number of segments, bearing smooth or serrated chaetae, and neuropodia with avicular uncini, either short or long handled, or both types present; uncini pectinate in *Loimia* Malmgren, 1866. Uncini always arranged in double rows at least on some chaetigers. Branchiae, if present, as 1–3 pairs of arborescent or tufted filaments. Several genera with lateral lappets on anterior segments (Hutchings 1997).

According to Hutchings (1997), Hutch-

ings & Glasby (1988, 1990), and Hutchings & Smith (1997), the most important characters for the identification of the terebellinean genera are the segment in which notopodia first appear, the number of pairs of notopodia, the structure of the blades of the notochaetae (serrated or smooth, when observed by light microscopy), the segment in which neuropodia first appear, the number of segments with uncini arranged in double rows, the dental formula of uncini, the presence and structure of branchiae, and the presence of lateral lappets on anterior segments.

Until recently, terebellineans have been called amphitritineans, but McHugh (1995), in a phylogenetic analysis of the subfamily, pointed out that it contains *Terebella* Linnaeus, 1767, the type species of the family Terebellidae, and, therefore, the name Terebellinae Linnaeus, 1767 should have priority over Amphitritinae Malmgren, 1866.

McHugh (1995) studied 22 morphological characters for the phylogenetic analysis of Terebellinae, using the type species of each known genus, except in cases in which the types were damaged. This study demonstrated that the group previously known as the subfamily Artacaminae should be considered as a clade within the Terebellinae, and the prominent peristomial "proboscis", as an autapomorphy for the genus *Artacama* Malmgren, 1866.

Genus *Morgana*, new genus

Type species.—*Morgana bisetosa*, new species.

Diagnosis.—Abranchiate terebellineans, without lateral lappets on anterior segments. Body slightly inflated on anterior chaetigers, with the 10 anteriormost chaetigers narrow and compacted; from posterior thorax onwards, segments larger, swollen, probably due to coelomic gametes; posteriormost segments much shorter, tapering to pygidium, with conspicuous external segmentation. Prostomium projecting ventrally, thickened and bilobed. Peristomium

restricted to a narrow ring, present only ventrally. Segments 2 and 3 achaetous; ventral shields narrow, present on anterior segments.

Notopodia from segment 4, at least 18 pairs of notopodia present (some specimens have up to 25 pairs of notopodia), notopodial glandular patches absent. Two types of notochaetae alternating within the same fascicle in all notopodia: bilimbate capillaries, minutely denticulate (by highest magnification of light microscopy), and serrated chaetae, usually spiralled around the adjacent capillary chaetae.

Neuropodia from segment 6 (chaetiger 3), to the end of the body, as slightly elevated tori. Neurochaetal uncini avicular, short handled, with prow and dorsal button well developed; arranged in double rows, face to face position, interlocking from chaetiger 8 (segment 11) to posterior body, for more than half of body chaetigers.

Discussion.—*Morgana* is characterized by the large number of thoracic chaetigers, with two types of chaetae in all notopodia and by the neuropodia with uncini arranged in double rows on more than half of the body chaetigers. This genus is an abbranchiate terebellinean, a group of poorly known species, some of which are known only from type material (Hutchings & Glasby 1988, McHugh 1995).

The general appearance of the body, the large numbers of notopodia and of neuropodia with uncini arranged in double rows make it very similar to *Baffinia* Wesenberg-Lund, 1950, according to the redescription by Fournier & Barrie (1984), but the latter differs from *Morgana* in that its anterior notopodia possess glandular patches and only bilimbate chaetae, posterior notopodia have only serrated chaetae, and neuropodia begin on segment 5 (Fournier & Barrie 1984, Hutchings & Glasby 1988, McHugh 1995), while *Morgana* lacks such glandular notopodial patches, has the two types of chaetae present in all notopodia, and neuropodia from segment 6.

The presence of neuropodia from seg-

ment 6 has been considered by McHugh (1995) as one of the autapomorphies of *Proclea* Saint-Joseph, 1894, but this genus differs from *Morgana* because it has 16 thoracic segments, compared to at least 18 in *Morgana*, lateral lappets on segments 2–4 that are absent in *Morgana*, and neuropodia with uncini arranged in double rows from segments 11–19, while in *Morgana* they are present in most of the body chaetigers (Fauvel 1927, Hutchings & Glasby 1988, Hutchings 1997).

Phylogenetically, *Morgana* should be placed in a group in which the relationships between genera could not be resolved using the characters of McHugh (1995), and it appears as a polytomy in her analysis. This group is defined by the presence of notopodial glandular patches on anterior chaetigers, and includes *Amphitritides* Augener, 1922, *Baffinia*, *Pseudoproclea* Hutchings & Glasby, 1990, and *Terebella* Linnaeus, 1767; although *Morgana* lacks such glandular patches, its general body aspect, and the structure of the notochaetae and neurochaetae are very similar to these genera, and so it is possible that the loss of the white notopodial glandular tissues has occurred secondarily in the evolution of this genus.

Amphitritides and *Terebella* are branchiate and so they clearly differ from *Morgana*; *Pseudoproclea* shares some similarities with *Morgana*, such as the presence of uncini in double rows on a large number of neuropodia and the absence of branchiae, but the structure of notochaetae is different, and neuropodia first appear on segment 5, with uncini arranged in double rows from segment 10, while *Morgana* has neuropodia from segment 6 and double rows of uncini from segment 11.

Finally, another abbranchiate genus similar to *Morgana* is *Phisidia* Saint-Joseph, 1894, which differs from the former by having only 14 pairs of notopodia, with notochaetae arranged in two tiers, and neuropodia from segment 5 (Hutchings & Glasby 1988, McHugh 1995). A more detailed

comparison between the characteristics of *Baffinia*, *Morgana*, *Phisidia*, *Proclea*, and *Pseudoproclea* is provided in Table 1.

McHugh (1995) was unable to score the character "notopodial glandular patches" for *Phisidia* and *Proclea* and scored them as unknown. If it is later found that they are present, or that its loss has occurred secondarily, they will probably belong to the same polytomic clade of *Amphitritides*, *Baffinia*, *Pseudoproclea*, and *Terebella*.

Etymology.—The generic name *Morgana* derives from Morgan Le Fay, from the Arthurian legend, as a homage to a friend of the first author, Maria Paula Martins Guerreiro, an admirer of King Arthur's novels.

Morgana bisetosa, new species
Figs. 1–2

Material examined.—20 specimens, all from Ilha dos Alcatrazes. Holotype and 4 paratypes, deposited at Museu de História Natural, Instituto de Biologia, Universidade Estadual de Campinas (holotype: MHN-BPO 80/0, paratypes: MHN-BPO 81/1–4); paratypes 5–7 deposited at The Australian Museum (W 27133). Holotype and three paratypes in 70% alcohol; four paratypes complete specimens, slide mounted; six specimens observed under SEM not preserved. Holotype and paratypes 1, 5–7 from Ilha dos Alcatrazes, paratypes 2–4 from Laje de Santos.

Description.—Small and slender animals, with 48–70 segments, preserved body usually curled, about 8–17 mm long, of which 2–3 mm are the buccal tentacles, and about 0.4–0.8 mm wide, at the level of chaetigers 4–6, the broadest part of the body (holotype with 62 segments, measuring 0.4 mm in width by 13.1 mm in length, of which the buccal tentacles extend through 2.2 mm). Preserved body whitish to pale orange, with long tentacles; tube mucous with debris. Body anteriorly inflated, with segments narrow, compacted and clearly distinct, ventral shields present on anterior segments, as narrow glandular patch-

es (Fig. 2C); posterior thorax with external segmentation indistinct; posterior segments well defined, tapering to pygidium. Prostomium ventrally projecting as two lobes (Figs. 1A, 2B, C). Peristomium restricted to a narrow ventral segment, with few lateral ocelli (Figs. 1A, 2B, C). Lateral lappets and branchiae absent.

Notopodia from segment 4, as transversal ridges until chaetiger 11 (segment 13), progressively becoming short cylinders from chaetiger 7, continuing until chaetiger 18–25 (segment 21–28; holotype with 20 pairs of notopodia). Two types of notochaetae present in all chaetigers: bilimbate capillaries minutely denticulate by highest magnification of light microscope, and serrated chaetae, very thin and flat, usually curled (Figs. 1B, C, 2D, E).

Neurochaetae from chaetiger 3 (segment 6), as avicular uncini, short handled, with large main fang and 6–8 transverse rows of small teeth (Figs. 1D, 2B, F–H); prow and dorsal button developed, the last with a tuft of hairy bristles below the main fang, only visible by SEM (Fig. 2F–H); uncini similar throughout. Uncini arranged in double rows from chaetiger 8 (segment 11; except for one specimen which has them from segment 12), face to face, for more than half of the body (Figs. 2G, H; holotype with uncini in double rows for 46 chaetigers); 8–14 posterior chaetigers with uncini in single rows. Pygidium simple, rounded.

Variation.—The specimens examined differed considerably in length and probably most of the variation observed in other characters is size-dependent. Buccal tentacles regenerating in some specimens. The number of thoracic chaetigers varies from 18 to 25, but the structure of notochaetae does not change. Uncini arranged in double rows from segment 11 in most of the specimens, from segment 12 in one specimen; the first chaetiger with uncini in double rows has only a few uncini in the row with the main fangs directed posteriorly, and a complete row from the next chaetiger; there are 29 to 38 segments with uncini in double

Table 1.—Morphological features of *Baffinia* Wesenberg-Lund, 1950, *Phisidia* Saint-Joseph, 1894, *Morgana*, n. gen., *Proclea* Saint-Joseph, 1894, and *Pseudoproclea* Hutchings & Glasby, 1990 (sources: Fauvel 1927; Fournier & Barrie 1984; Hutchings & Glasby 1988, 1990; Hutchings 1997).

Characters	<i>Baffinia</i>	<i>Morgana</i>	<i>Phisidia</i>	<i>Proclea</i>	<i>Pseudoproclea</i>
Lateral lappets on segments 2-4	absent	absent	absent	present	absent
Notopodia (from segment 4 in all these genera)	until near posterior end	extending through 18-25 segments	extending through 14 segments	extending through 16 segments	extending through 16 segments
Notochaetae	in anterior chaetigers, bilimbate, with serrated tips; from chaetiger 10-12 geniculate, with strongly serrated tips	bilimbate capillaries (minutely denticulated by light microscopy) and serrated chaetae, in alternating positions in all notopodia	in two tiers: the longest tier with broad-bladed, narrowly limbed capillaries, with smooth tips; the shortest tier with the same chaetae together with alimbate serrated chaetae	in anterior chaetigers, short alimbate chaetae and long capillaries, with smooth limb; from chaetiger 9, short coarsely serrated chaetae together with long capillaries, with limb striated	in anterior chaetigers, long bilimbate smooth-tipped capillaries, and short serrated chaetae; from chaetiger 8, long capillaries distally serrated and with short limb, together with coarsely serrated chaetae
Neuropodia from segment	5	6	5	6	5
Neuropodia with uncini arranged in double rows	from segment 14 (in type species), for 20 or more chaetigers	from segment 11, for 29-38 chaetigers	from segment 11, for 10 chaetigers	from segment 11, for 9 chaetigers	from segment 10 until posterior end

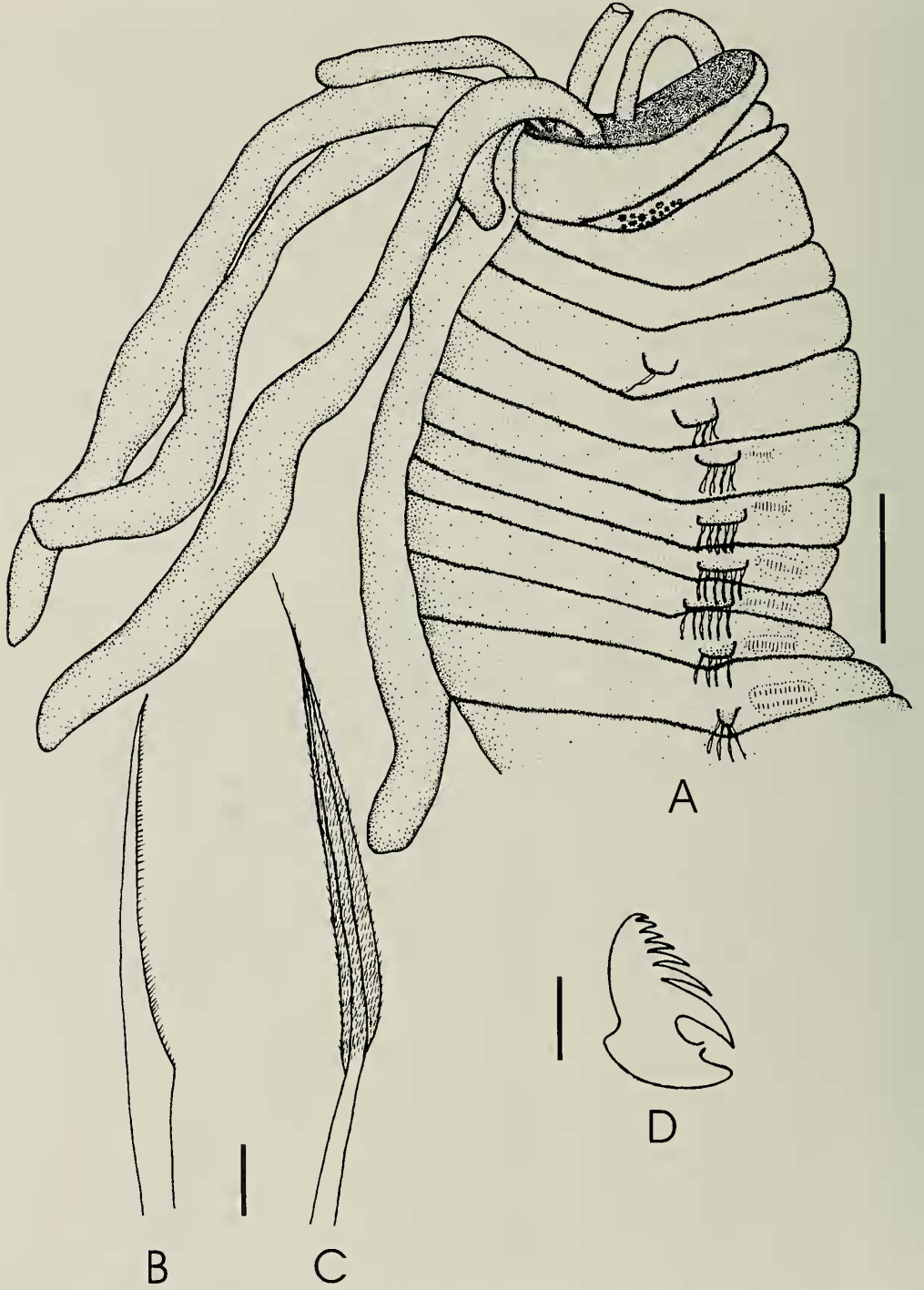


Fig. 1. *Morgana bisetosa* gen. n., sp. n. A—anterior end, lateral view; B—serrated notochaeta; C—bilimbate capillary notochaeta; D—uncinus, lateral view. Scale bars: A—200 μ m; B, C—10 μ m; D—5 μ m.

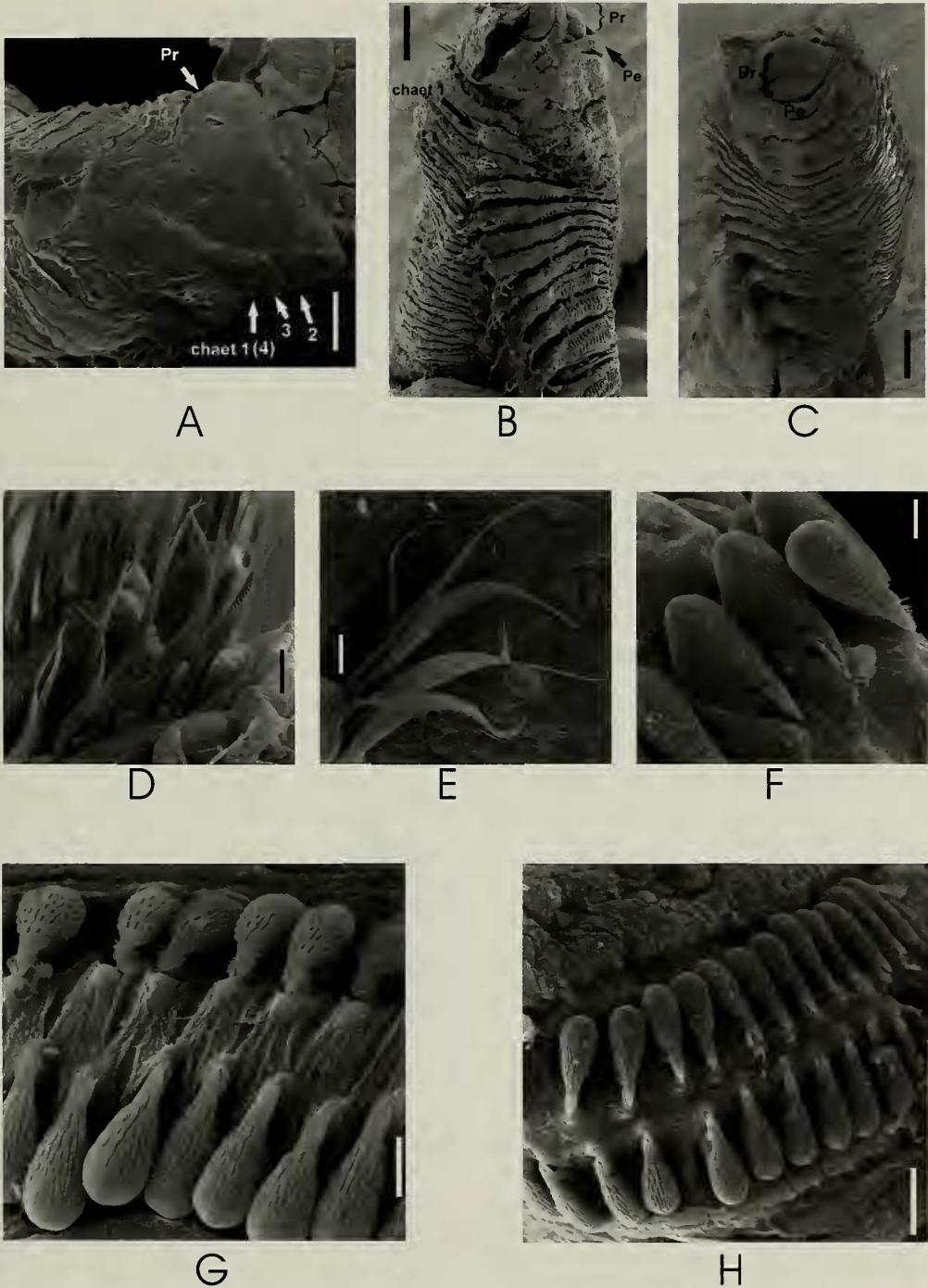


Fig. 2. *Morgana bisetosa* gen. n., sp. n. A—anterior end, dorsal view; B—same; lateral view; C—same, ventral view; D—notochaetae, chaetiger 3; E—notochaete, chaetiger. 23; F—anterior thoracic uncini; G—median thoracic uncini; H—abdominal uncini. Pe—peristomium; Pr—prostomium; chaet 1—chaetiger 1; the numbers refer to the segments. Scale bars: A—150 μ m; B, C—100 μ m; D—20 μ m; E—15 μ m; F—5 μ m; G—8 μ m; H—15 μ m.

rows; in spite of the variation in length, all specimens observed have uncini arranged in double rows on more than half of the body chaetigers.

Etymology.—The specific name *Morgania bisetosa* refers to the two types of notochaetae this species possesses in all notopodia; it derives from the latin prefix *bi-* = “two” + *setosus* = “bristly”, from *seta* = “bristle”.

Subfamily Telepodinae Hesse, 1917

Telepodinae are characterized by: branchiae, if present, as unbranched filaments, sometimes very numerous; neuropodia with uncini always in single rows, rows sometimes curved or forming a loop, but never in two rows as in Terebellinae; and body without clear distinction between thorax and abdomen (Hutchings & Glasby 1987). According to these authors, the most important features for the identification of genera and species are the morphology and the arrangement of branchiae, the segments on which notopodia and neuropodia first appear, and the shape and dental formulae of neuropodial uncini.

Genus *Streblosoma* Sars, 1872

Streblosoma.—Hutchings & Murray, 1984:93–95; Hutchings & Glasby, 1987:222–226.

Type species.—*Grymaea bairdi* Malmgren, 1866, designated by Sars (1872).

Diagnosis.—Species with compact tentacular lobe, with notopodia from segment 2 and neuropodia from segment 5; notochaetae marginally smooth or minutely denticulate (by highest magnification of light microscope), for a variable number of segments; neuropodia with uncini arranged in single rows throughout. Branchiae usually present, as pairs of unbranched filaments on segments 2–4, very numerous in most species (Hutchings & Glasby 1987, Hutchings 1997).

Streblosoma oligobranchiatum, new species Figs. 3–4

Material examined.—Nine specimens, all from Ilha dos Alcatrazes. Holotype and three paratypes deposited at Museu de História Natural, Instituto de Biologia, Universidade Estadual de Campinas (holotype: MHN-BPO 81/0, paratypes: MHN-BPO 81/1–3), two paratypes deposited at The Australian Museum (W 27132). Holotype and one paratype in 70% alcohol, other paratypes slide mounted; three specimens observed under SEM not preserved.

Description.—Small species, with 32–42 segments, measuring about 7.5–9.5 mm in length, of which 2–3 mm of buccal tentacles, and about 0.75–0.9 mm in width (holotype with 40 segments, measuring 9.5 by 0.8 mm). Preserved animal whitish to pale orange; anteriorly inflated, with segments clearly distinct; posterior thoracic and most of abdominal chaetigers swollen, with external segmentation indistinct, due to presence of coelomic gametes; posteriormost segments clearly defined, tapering to pygidium. Buccal tentacles with dark pigmented spots, spread along their length on two very narrow dark lines (Fig. 3A). Peristomium with numerous eyespots, irregularly placed in 1–2 rows, more concentrated laterally (Fig. 3A). Peristomium separated from segment 2 by a thickly ciliated sulcus dorsally (Fig. 4E). Branchiae as single filaments, inserted asymmetrically above notopodia in segments 2–4; left side: two filaments on segment 2 and one on segment 3; right side: one filament on segments 2–4; lateralmost filament on left segment 1 about half the length of the others (Figs. 3A, 4A–C).

Notopodia from segment 2, continuing until segment 23–27 (until segment 23 in holotype), as short elongate podia. Notochaetae as bilimbate capillaries, with long, gently tapering tips, on anterior chaetigers (Fig. 4F); two types of notochaetae from segment 5 (chaetiger 4), arranged in two fascicles: superior chaetae as those on pre-

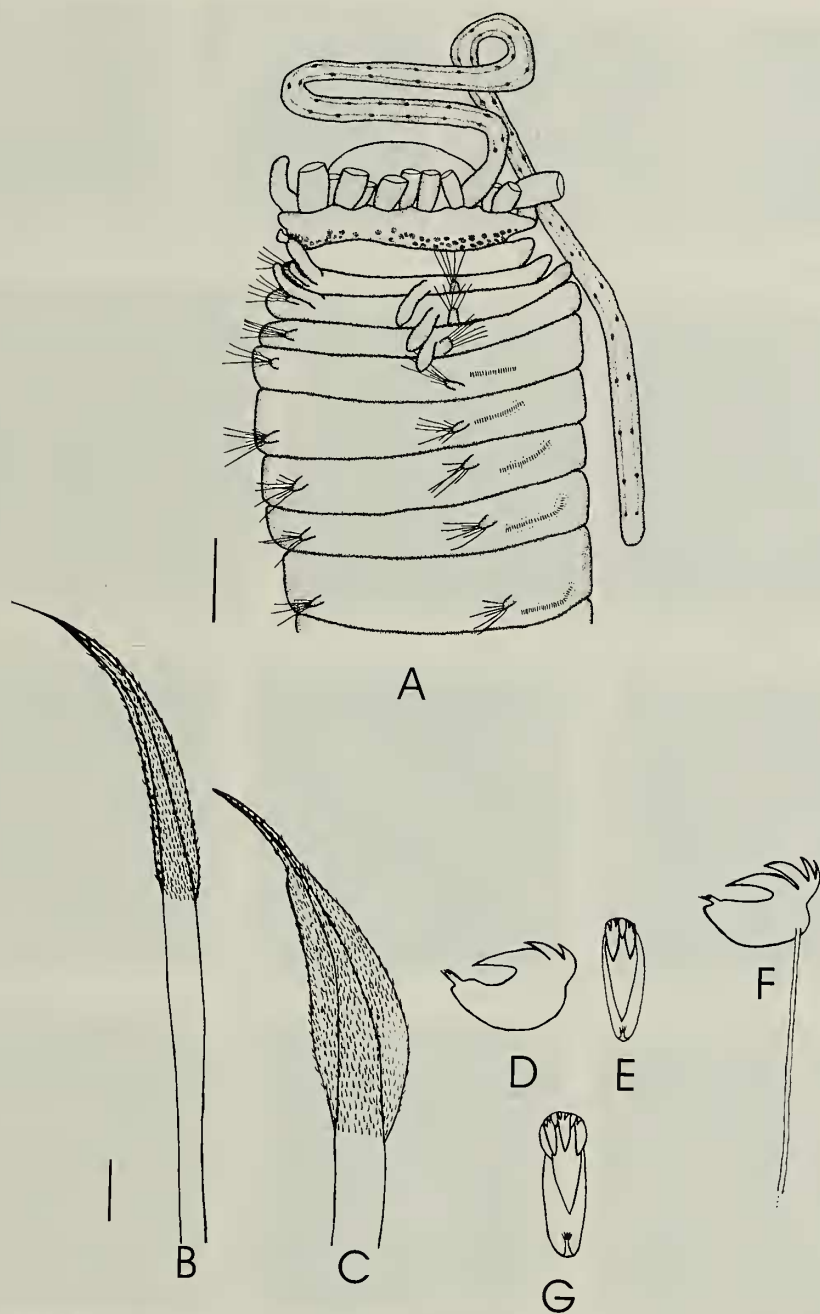


Fig. 3. *Streblosoma oligobranchiata* sp. n. A—anterior end, dorsolateral view; B—superior thoracic notochaeta; C—inferior thoracic notochaeta; D—uncinus, chaetiger 5, lateral view; E—same, frontal view; F—abdominal uncinus; G—uncinus, chaetiger 20. Scale bars: A—200 μ m; B—G—10 μ m.

vious chaetigers, inferior notochaetae also bilimbate with acuminate tip, but much shorter and with broader limb, nearly spatulate (Figs. 3B, C, 4 G—I); both types mi-

nutely denticulate by highest magnification of light microscopy.

Neuropodia from segment 5 (chaetiger 4), until posteriormost segments; in anterior

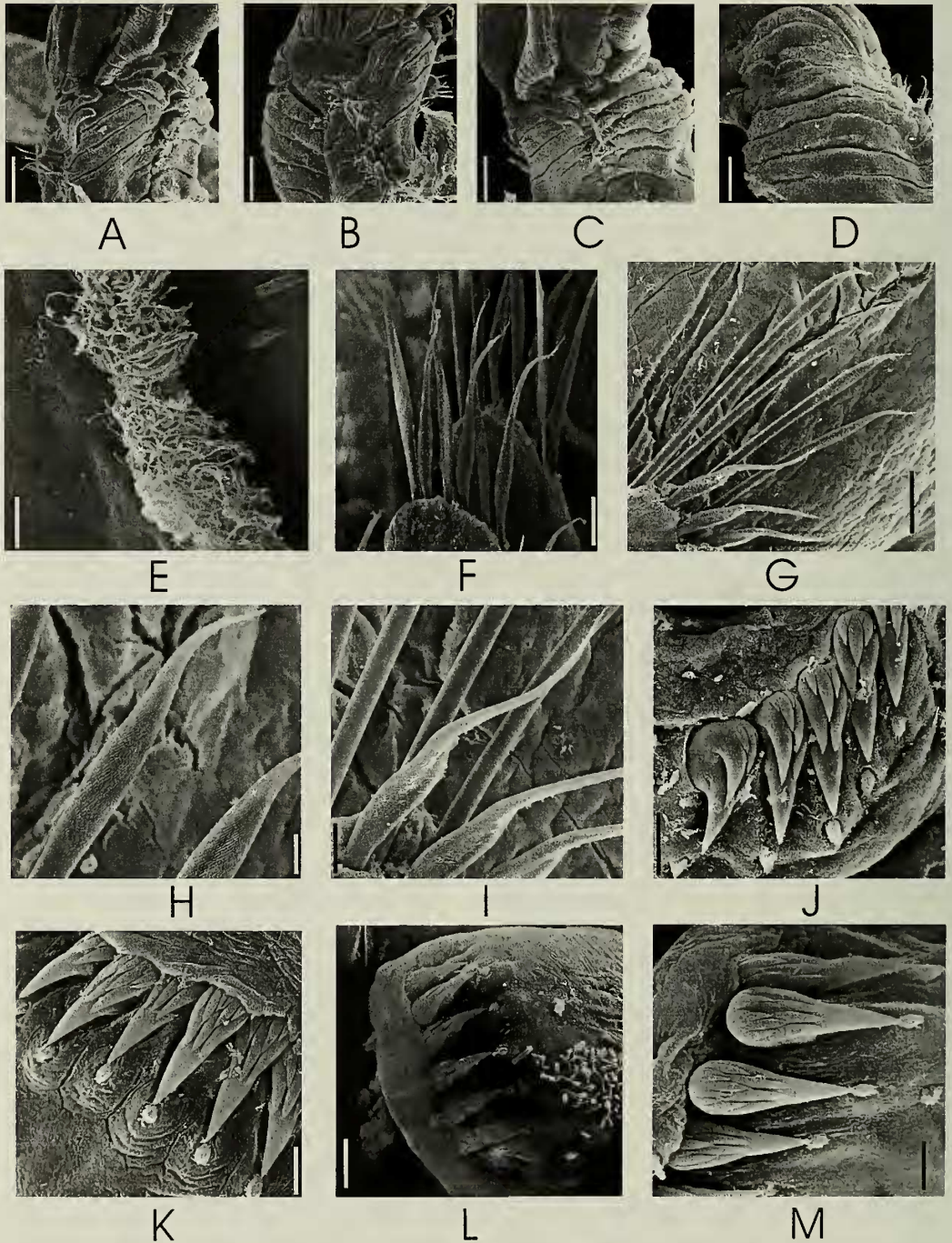


Fig. 4. *Streblosoma oligobranchiata* sp. n. A—anterior end, dorsal view; B—same, left lateral view; C—same, right lateral view; D—same, ventral view; E—dorsal separation between peristomium and segment 2; F—notochaetae, chaetiger 3; G—notochaetae, chaetiger 7; H—detail, superior notochaetae; I—detail, inferior notochaetae; J—uncinus, chaetiger 5; K—uncini, chaetiger 15; L—abdominal neuropodial papillae; M—abdominal uncini. Scale bars: A–D—200 μ m; E—10 μ m; F—30 μ m; G—40 μ m; H—10 μ m; I—15 μ m; J, K—10 μ m; L—15 μ m; M—8 μ m.

chaetigers, as glandular tori, only slightly elevated; from posterior thorax, forming more erected pinnules (Fig. 4L). Neurochaetae as avicular uncini, always arranged in single rows; dorsal button developed, as a circular plate of short bristles in front of main fang (Figs. 3D–G, 4J–M); prow short; number of rows of secondary teeth increasing progressively towards pygidium; dental formula: anterior chaetigers: MF + 2 + 5 (last row with unequal teeth; Figs. 3D–E, 4J); posterior thoracic uncini: MF + 3 + 7 + 2 (last two rows with unequal teeth; Figs. 3F, 4K); abdominal uncini: MF + 4 + 9 + 2 (last two rows with unequal teeth; Figs. 3G, 4L, M). From posterior thorax, uncini with long and thin handles, along neuropodial pinnules (Fig. 3F).

Variation.—The number of segments with notopodia varies from 22–26; uncini may be present until last chaetiger before pygidium, or may be lacking on 1–6 posteriormost segments.

Discussion.—The genus *Streblosoma* Sars, 1872 is characterized by: branchiae, if present, as single unbranched filaments, inserted laterally on segments 2–4; notochaetae from segment 2; neurochaetae from segment 5.

Hutchings & Glasby (1987) pointed out that the structure of the tips of notochaetae, if marginally smooth or serrated, should not be regarded as an important character, as by SEM all notochaetae appear marginally serrated. We can add to the authors' statement that, as far as we have seen after examining chaetae of several polychaete families by SEM, limbate chaetae are always marginally serrated, and our capacity to see the denticles by light microscopy depends on the power of the apparatus and on the size of the denticles; in the case of *S. oligobranchiatum*, when notochaetae are magnified about 1000× by light microscopy, the limbs appear quadriculate, due to the denticles.

This genus includes many species, but, except for *S. minutum* Hutchings & Glasby, 1987, all the branchiate species have many

more branchial filaments than *S. oligobranchiatum* (Kritzler 1971, Hutchings & Glasby 1987, Hutchings 1997). Even though all material examined was small, they were mature individuals, as several had abundant coelomic gametes. *Streblosoma oligobranchiatum* n. sp. is very close to *S. minutum*, differing from it by the arrangement of branchial filaments, the presence of bilimbate notochaetae, the dental formulae, and by having uncini with long and thin handles, from posterior thorax.

Etymology.—The specific name *Streblosoma oligobranchiatum* refers to the small number of branchial filaments present in this species; it derives from the prefix *oligo* = "few" + *branchiae*.

Acknowledgments

We would like to thank to CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico and FAPESP - Fundação de Amparo à Pesquisa do Estado de São Paulo for the financial support for this study; to the Curso de Pós-Graduação do IB-USP, namely Erika Schlenz and Fábio Lang da Silveira; to Pat Hutchings, for reviewing this paper and for her comments and valuable suggestions; to the staff of the Laboratório de Microscopia Eletrônica do IB-USP, partially supported by Auxílio PROAP/98 - CAPES, and the technician Ênio Mattos; to the staff of Laboratório de Microscopia Eletrônica do IB-UNICAMP, technicians Adriane Sprogis and Antônia M. de Lima; to Fausto Pires de Campos and Tatiana Neves-IF-Instituto Florestal- for allowing the collection on both islands, which are protected areas in the state of São Paulo; and to Carlos E. F. da Rocha and Sérgio A. Vanin (IB-USP), for lending us their drawing tubes.

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